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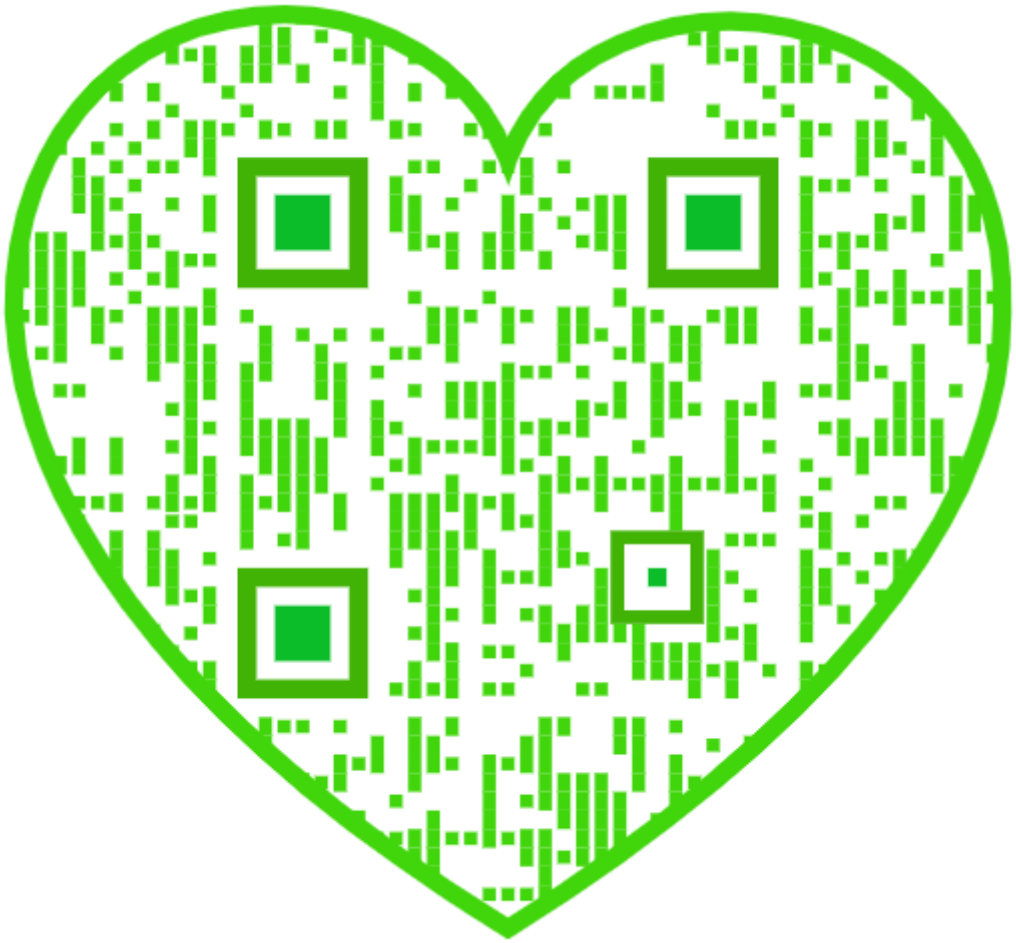

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On the mite (Acarapis woodi, Rennie) ass

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On the Mite (Acarapis woodi, *Rennie*) *associated with Isle of Wight Bee Disease.*

By STANLEY HIRST.

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THE discovery of the constant presence of a mite in bees suffering from Isle of Wight disease is of considerable interest. The first scientific account of the mite and its relations with the disease has been published by the discoverers (Dr. Rennie, P. B. White, and Miss Elsie J. Harvie) *. The present note deals with the affinities of the mite, and gives a detailed account of its external structure. My best thanks are due to the Rev. G. H. Hewison and Mr. W. Herrod-Hempsall for giving me bees infected with *Acarapis woodi*.

Genus ACARAPIS, Hirst, 1921.

Acarapis, Hirst, Proc. Zool. Soc. 1921, p. 357.

Closely allied to *Tarsonemus*, but differing as follows:—Second and third legs of larval stage very short (almost rudimentary) and without either claws or pulvillus (whereas in the larva of *Tarsonemus* these legs are about as long as the first and provided with paired claws and a pulvillus). Female lacking the club-shaped pseudostigmata that are present in *Tarsonemus*, and with the fourth leg shorter and wider and provided with more numerous hairs (in this last respect somewhat resembling the fourth leg of *Scutacarus*).

* Trans. Roy. Soc. Edinburgh, lii. part 4, March 1921, pp. 737–779, 3 pls.

Acarapis woodi, Rennie, 1921.

Tarsonemus woodi, Rennie, Trans. Roy. Soc. Edinburgh, lii. 1921, pp. 768–779, 2 text-figs., 1 pl.

♀.—Body oval, being longer than wide. Segmentation not very distinct; one of the transverse lines is much more distinct than the others and divides the body into a cephalothoracic and an abdominal division. Specimens mounted in fluids and examined with a $\frac{1}{12}$ oil-immersion are seen to have five weak dorsal tergites, separated from one another by transverse lines and also by minute longitudinal striations. At the posterior end there is a minute, almost annular projection, possibly representing an additional segment. Stigmata minute, but distinct, being paired; one is placed on each side of the neck-like elongation of the anterior end of the body.

Venter.—Sternal epimeron Y-shaped. Posterior epimera much weaker than those of the anterior pairs of legs. There is a minute Y-shaped chitinous structure midway between the legs of the third pair. In the middle line between the last pair of legs there is a slight projecting lobe divided into two by a minute indentation in the middle.

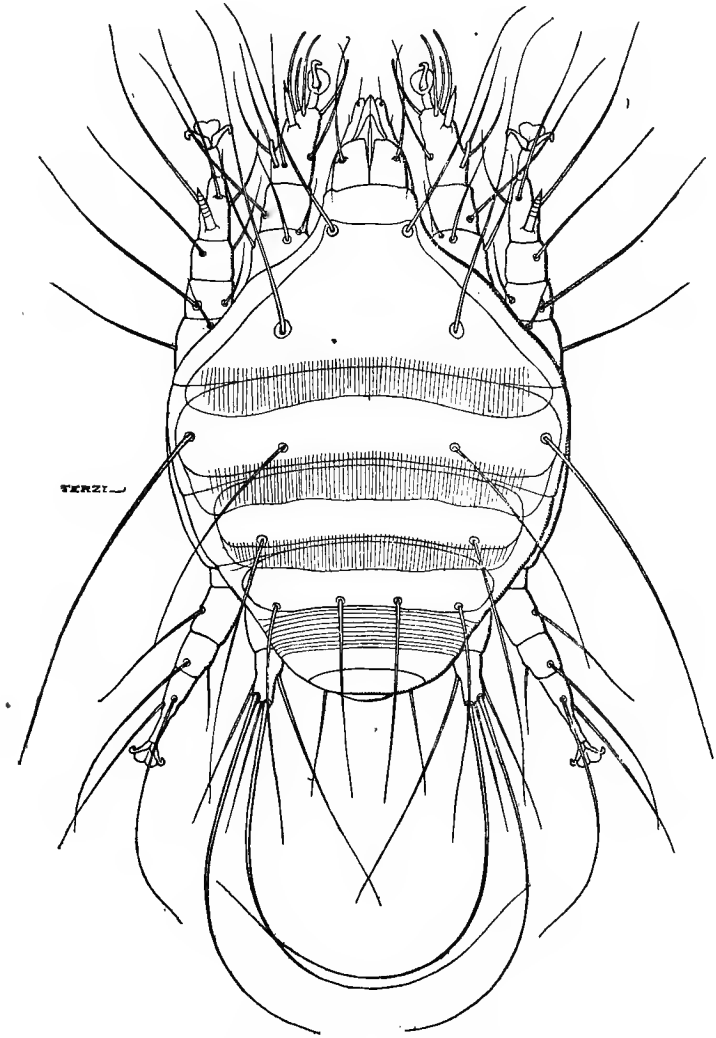
Chætotaxy of Body.—Sixteen hairs are present on the dorsum, all of them being long, except the last pair, which are shorter. On the cephalothorax (first tergite) there are two pairs, one placed behind the other. Second tergite (first of abdomen) with four hairs, third with a pair, fourth with four, the small posterior tergite with a pair. There is a hair on each of the anterior forks of the sternal epimeron, and another pair placed in front of the dividing-line between cephalothorax and abdomen; also two pairs of shorter hairs on the abdomen between the legs.

Legs.—First leg with only one claw and with a well-developed pulvillus, almost circular in shape; second and third legs with a pair of strong claws, with a pulvillus in between them; fourth leg much shorter than the others, and without either claw or pulvillus, and furnished with long hairs.

Chætotaxy of Legs.—There are a number of hairs on the legs, including some very long and fine dorsal hairs. Besides these ordinary hairs, there are a number of modified hairs. Tarsus of first leg dorsally with a rather large striated "olfactory" hair, which is sharply pointed at the distal end, and also another much shorter one laterally. A large

"olfactory" hair is also present on the second tarsus. There

Fig. 1.



Acarapis woodi, ♀, dorsal view.

are also two pairs of rather long, curved, slender sensory

hairs, with their end blunt, as if broken off, placed dorsally near the end of the first tarsus. Fourth leg with five hairs; three of them, of varying length, arise some distance from the distal end, the other two are placed at the extreme end of the tarsus, one of them being very long and fine, the other fairly long.

Tracheal tubes distributed as shown in fig. 5.

♂.—*Dorsum* consisting of only three distinct divisions or tergites, the first (cephalothoracic) being large, the second (first abdominal) still larger, the posterior one quite small and oval in shape. There is also the curious little caudal structure present as well in the males of *Tarsonemus*.

Chætotaxy of Dorsum.—There are in all twelve hairs on the dorsal surface—viz., two pairs on the first tergite, one placed behind the other, an anterior row of four and a posterior pair on the second tergite, and a pair of shorter hairs on the small posterior tergite.

Palp.—Slender, apparently unsegmented, and of small size, but fairly elongated; two minute hairs are present on it.

Cheliceræ.—Long and styliform, as in the female and larva.

Legs.—With the exception of the last one, the legs are very like those of the female. Fourth leg somewhat shorter than the others, and without claws or pulvillus; it is divided into three free segments, the basal one being the stoutest and bearing a single hair; the second segment with two ventral and one rather long fine dorsal hair; tarsus ending in a short blunt spine and a very long fine hair.

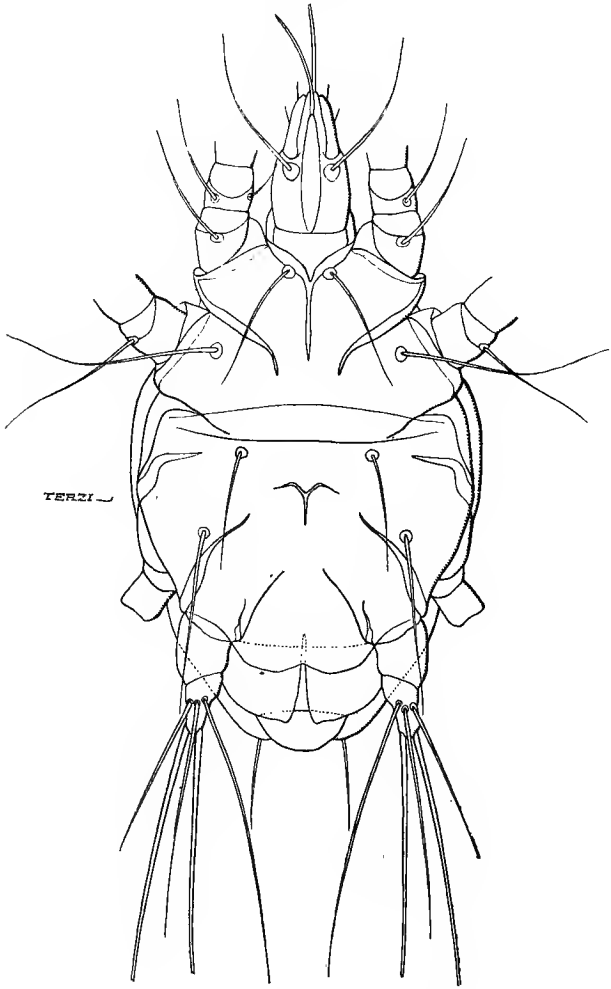
Nymphal Stage.—There is no free nymphal stage, but if the larval skin containing a fully developed adult of either sex is carefully examined, an inner delicate chitinous membrane (without any trace of limbs) enveloping the mite can be found, and perhaps it represents the nymphal stage.

Larval Stage differing considerably in size and general appearance according to the degree of development. It is elongated and usually egg-shaped or sac-shaped.

Dorsum with bands of transverse striations alternating with plain unstriated areas; the latter are possibly weak tergites, and bear very short hairs—one pair on the first area, two pairs on the second, one pair on the third, two pairs on the fourth; the first (cephalothoracic) tergite appears divided in two when examined from above, so there is evidence of five segments in the larval stage. Posteriorly (ventrally) there is a minute oval (anal) plate at the extreme end of the body. Laterally there are a number of straight and curved

lines or striations. Sternal epimeron Y-shaped, the anterior end being forked.

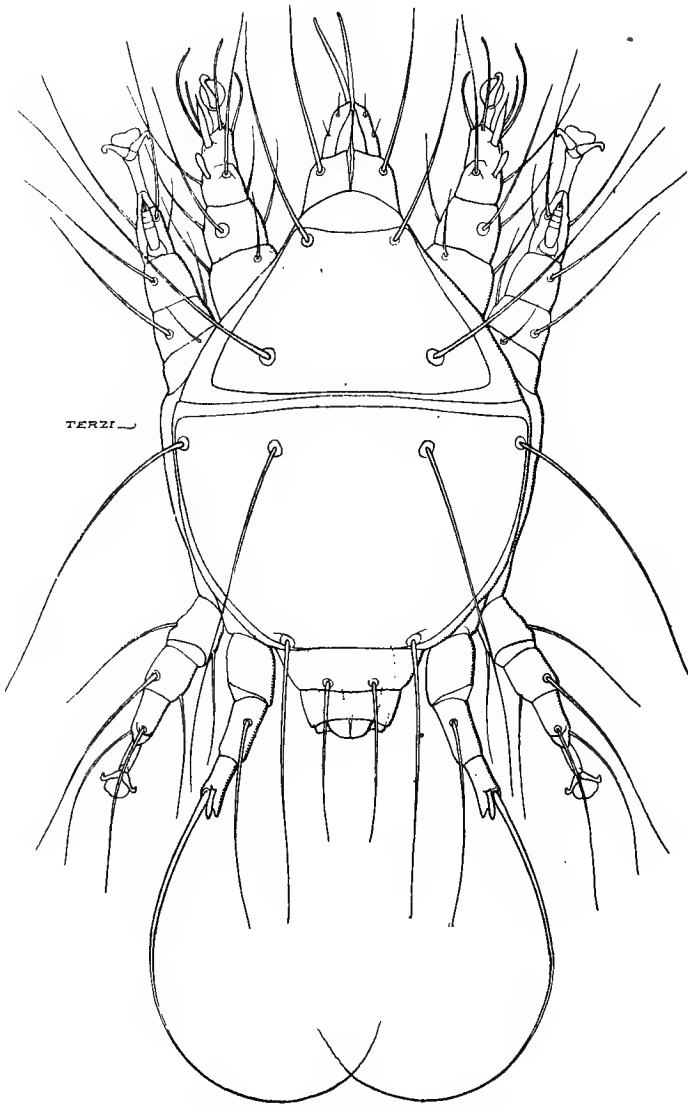
Fig. 2.



Acarapis woodi, ♀, ventral view.

Legs.—First pair of legs alone well-developed, the second and third pairs being much shorter and not so distinctly

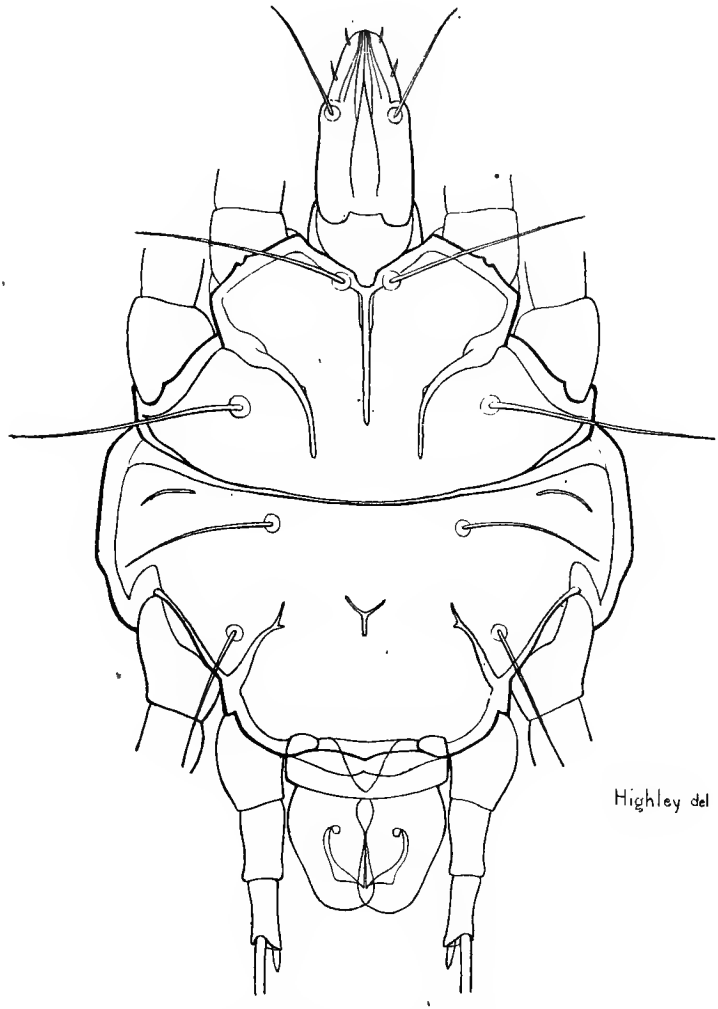
Fig. 3.



Acarapis woodi, ♂, dorsal view.

segmented (four segments can be distinguished, however). First pair of legs ending in a pair of well-developed claws

Fig. 4.

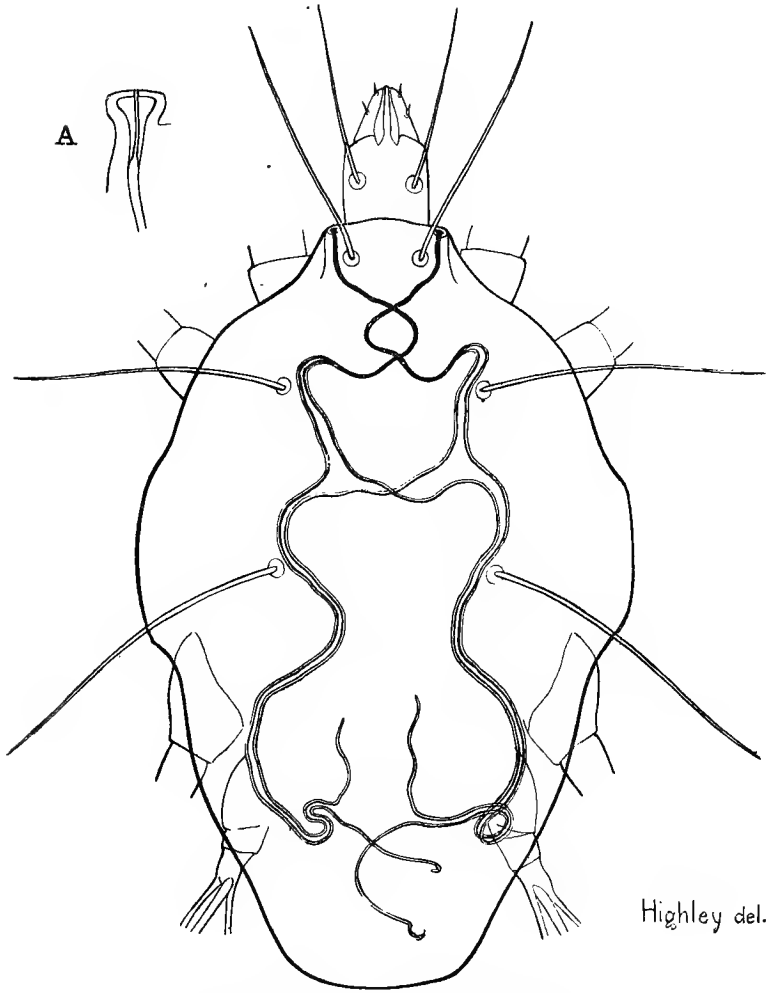


Acarapis woodi, ♂, ventral view.

with an almost heart-shaped pulvillus between them. There is a short hair on the second segment from the distal end of

this leg, and the tarsus has two hairs on it—viz., a comparatively long, blunt, curved hair dorsally (probably sensory)

Fig. 5.



Acarapis woodi, ♀. The tracheal system.
A, stigmal opening.

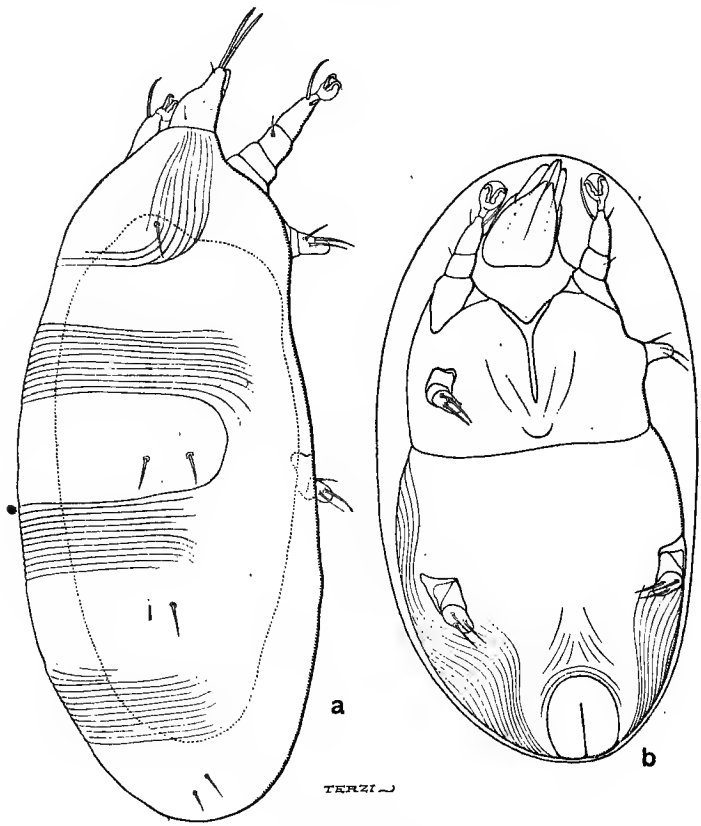
and a short blunt hair. Second and third legs with the tarsus in the form of a short cone, without either claws or pulvillus,

and furnished with three hairs, one being shorter than the others.

Egg of considerable size, being remarkably large for a mite of such small size.

Measurements.— ♀. Length (incl. capitulum) 123–180 μ

Fig. 6.



Acarapis woodi.

a, lateral view of larva; b, ventral view of same whilst still enclosed in egg-shell.

[the largest specimens being probably ovigerous]; width 76–100 μ.

♂. Length 96–102 μ; width 62 μ.

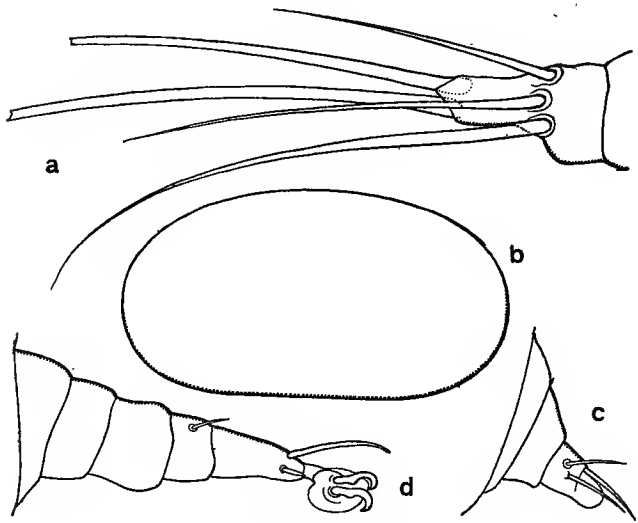
Ovum 110–128 μ in length, its width 54–67 μ.

Host. Honey-bee (*Apis mellifica*).

Note.—Apparently only adult bees are infested by this mite, which lives in the tracheal tubes of the head and thorax. It is not known how infection takes place—possibly by bees visiting the same flower or drinking-place. Many species of Tyroglyphidæ have a migratory or travelling stage (hypopus), but this stage is not known to occur in the Tarsonemidæ.

In his "Acarina or Mites" (Report No. 108, U.S. Dept. Agricult. 1915, p. 109) Mr. Nathan Banks asserts that "The curious [Tarsonemid] genus *Scutacarus* has a migratorial nymphal stage much like the hypopus of the Tyroglyphidæ.

Fig. 7.



Acarapis woodi.

a, last leg of female; **b**, ovum, greatly enlarged; **c**, first leg of larva; **d**, second leg of larva.

This stage has been found on bees and ants." This is a mistake, however, for it has been pointed out by Michael ('British Tyroglyphidæ,' vol. i. p. 126), and also by Enzio Reuter in his very excellent paper "Zur Morphologie und Ontogenie der Acariden" (Acta Soc. Fennicæ, xxxvi. 1909), that the nymphal stage is suppressed in *Disparipes* (=*Scutacarus*).

The hypopial stage is always a nymph, and there is no free nymphal stage either in *Acarapis* or *Tarsonemus*; so that it is probable that the disease spreads through the adult mite.

After the death of the bee the mites continue to live for several days, and the great majority of them seem to die finally without leaving the body of the host. Occasionally a few adult mites may be found moving about on the dead bodies of the bees. Whilst dissecting some healthy hive-bees from Golder's Green, I found a single specimen of a male *Tarsonemus* (sensu stricto) in one of the thoracic tracheæ—so that more than one species of mite of this family can gain access to the respiratory system of the bee. I have also found specimens of *Tarsonemus* (s. s.) on dry specimens of *Apis dorsata* and *Apis florealis* (both Indian species of bees) and on *Apis mellifica*, var. *indica* (from Singapore).